Appendix 4.8

Qualitative Review on Effect due to Adoption of the New Maritime Emission Factors

Qualitative Review on Effect due to Adoption of the New Maritime Emission Factors

1 BACKGROUND

1.1.1 With reference to the KTD Schedule 3 EIA report, it was identified Panamax vessels berthed at both Phase I and Phase II Berths is the worst case scenario. The emission rates for Panamax cruise vessel are estimated based on the power rating of the propulsion engine of Queen Elizabeth II.

1.1.2 In Schedule 3 EIA report, the emission rates of air pollutants from the operation of the engine of cruise vessels were estimated based on the approach stipulated in Current Methodologies and Best Practices in Preparing Port Emission Inventories, Final Report, January 2006 prepared by ICF Consulting for USEPA (ICF 2006).

1.1.3 In April 2009, USEPA published a final report on current methodologies in preparing mobile source port-related emission inventories (ICF 2009).

1.1.4 This review aims to provide a comparison of ICF 2006 and ICF 2009 on estimation of emissions from cruise vessel using a qualitative approach.

2 QUALITATIVE REVIEW

2.1.1 The table below shows the comparison of emission factors between ICF 2006 and ICF 2009 for the propulsion and auxiliary engine of Panamax cruise vessel.

2.1.2 In addition to propulsion and auxiliary engines, ocean going vessels also have boilers used to produce hot water. The calculation method for boiler emission is also updated and results in increase the emission for both NO_x and PM10.

Table 1 – Emission factors of propulsion engine for Panamax cruise vessel

Pollutants	Emission Factor in g/kWh		
	ICF 2006	ICF 2009	% increase
NO_x	14	14	0%
PM10 (RSP)	1.14	1.43	25%

Table 2 – Emission factors of auxiliary engine (for Maneuvering/Idling) using residual oil for Panamax cruise vessel

Pollutants	Emission Factor in g/kWh		
	ICF 2006	ICF 2009	% increase
NO_x	14.7	14.7	0%
PM10 (RSP)	1.14	1.44	26%

2.1.3 As SO_2 and particulates (PM10) emission factors are directly proportional to the sulphur content of the fuel, SO_2 and particulates (PM10) emission factors should be adjusted if the sulphur content of the fuel is different from the assumption of 2.7% assumed in the ICF reference. In Schedule 3 EIA report, 3.8% of the average sulphur content was assumed. Therefore, a correction factor of 1.41 (i.e. 3.8/2.7) was applied in the estimation of emission rates of SO_2 and particulates in the Schedule 3 EIA. With reference to the EPD website (last revision date: 4 October 2012), the ocean going vessels run on residual oil, whose sulphur content is 2.8% on average. In this regards, the correction factor of 1.03 (i.e. 2.8/2.7) can be applied in the estimation of emission rates of SO_2 and particulates.

2.1.4 In conclude, there are two major updates would affecting the emission rates which are (i) increased emission factors from ICF 2009 and (ii) average sulphur content decreased from

3.8% to 2.8%.

2.1.5 The calculated emission rate based on the ICF 2009 and ICF 2006 (i.e. extracted from Schedule 3 EIA report) are shown in below tables.

2.1.6 From the below tables, emission rates of cruise vessels for the pollutants of NO_x and RSP will increase about 1% to 3%, respectively, when using the latest information. For the tug boat, the emission rate for NO_x will increase about 4%, while the emission rate for RSP will decrease by about 23%.

ICF 2006 emission data for Panamax

Emission Rate	Maneuvering (15mins)	Hotelling (30mins)	Hotelling (60mins)
NO_2 (g/s)	2.7688E+00	3.8834E+00	7.7669E+00
PM10 (g/s)	1.5208E+00	2.1202E+00	4.2403E+00

3.8% average sulphur content of fuel supplied/used in Hong Kong was assumed in S3 EIA report.

ICF 2009 emission data for Panamax

Emission Rate	Maneuvering (15mins)	Hotelling (30mins)	Hotelling (60mins)
NO_2 (g/s)	2.7959E+00	3.9375E+00	7.8750E+00
PM10 (g/s)	1.5186E+00	2.1821E+00	4.3642E+00

With reference to the EPD website, 2.8% average sulphur content used in Ocean Going vessels

% Increase for Panamax

	Maneuvering (15mins)	Hotelling (30mins)	Hotelling (60mins)
NO_2 (g/s)	1.0%	1.4%	1.4%
PM10 (g/s)	-0.1%	2.8%	2.8%

Tug Boat - Emission Rate (g/s), 15 mins

	ICF 2006	ICF 2009	% Increase
NO_2 (g/s)	9.1729E-02	9.5428E-02	4%
PM10 (g/s)	6.3376E-02	4.8582E-02	-23%

3 CONCLUSION

3.1.1 As shown in the following table, the highest cumulative annual average concentration of NO_2 and RSP at ASRs in this Project is 75 and 53 µg/m^3, respectively.

	Predicted Annual Concentration	
	NO_2	**RSP**
Vehicle emission with background	72	51
Vehicle + other emissions (include marine) with background	75	53
Contribution from other emissions (include marine)	3	2
% increase for other emission	4%	2.8%
Adjusted emission concentration	3.1	2.1
Adjusted cumulative concentration	75	53

3.1.2 The breakdown of the contributions from different sources shows that marine emission, as part of the overall other emissions, only accounts for a small proportion of the cumulative concentration, which is less than 3 and 2 µg/m^3 for NO_2 and RSP, respectively.

3.1.3 As a conservative approach, applying the above calculated increase factors of marine emission (i.e. 4% for NO_2 and 2.8% for RSP) to the contribution from overall other emissions, the adjusted cumulative concentrations remains the same as the assessment results of the EIA study.

3.1.4 In conclusion, taking into account the latest emission data (stated in ICF 2009) and the up-to-date 2.8% sulphur content of the fuel, the calculated increase factors of marine emission are 4% for NO_2 and 2.8% for RSP, respectively. The effect due to the adoption of the latest marine information is insignificant and all the air sensitive receivers in the vicinity of the Project site would comply with the Air Quality Objectives. Therefore, quantitative assessment is considered not necessary.